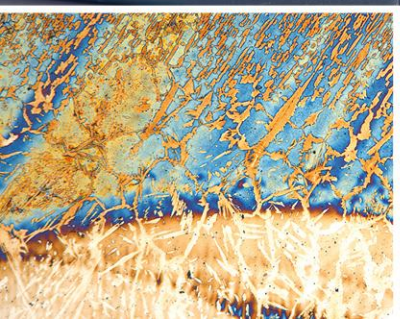
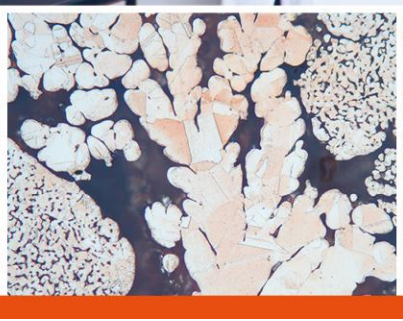
MATERIALOGRAPHY & HARDNESS TESTING

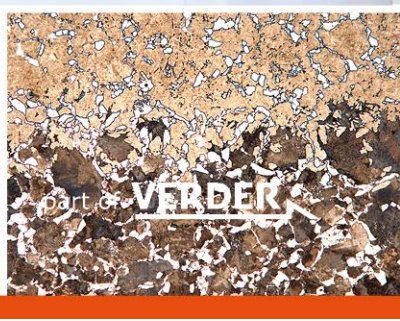
# Application lab. report

## Nitrided Layer

## Preparation to analyze the nitrided layer







# QATM-Preparation method

## Objective

The aim of the investigation is to determine a suitable preparation method to analyze the nitrided layer for the received samples (Figure 1). The following devices are to use. For cutting the Qcut 400 A, mounting with Qpress 50, grinding and polishing Saphir 560 (we use Saphir 550) and for hardness testing the Qness 60 A+.

**Note:** The item numbers of the consumables, clamping tools and sample holders could be found in a table at the end of the report.

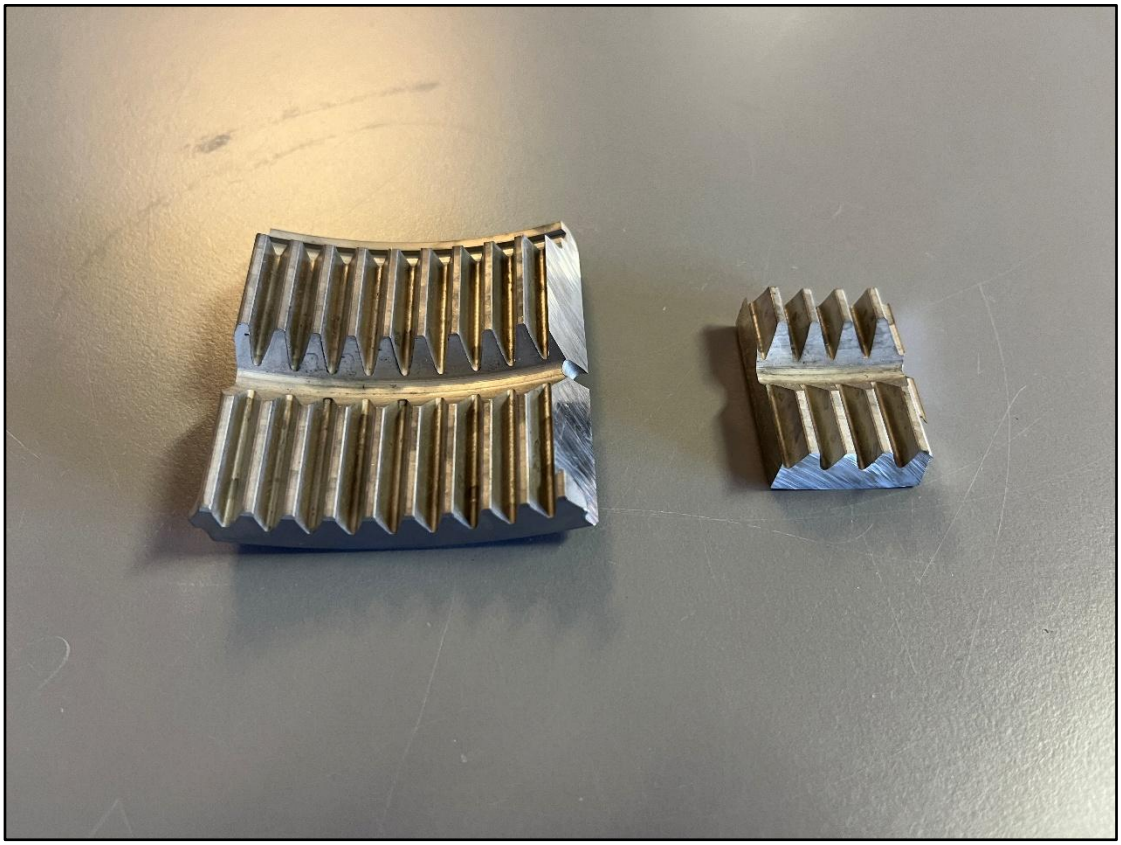


Figure 1. As-received samples

# QATM-Preparation method

## Cutting

| Cutting | | | |
|---|---|---|---|
| Device | Cut-off disc | Anti-corrosion coolant | Clamping tool |
| **Qcut 400 A** | Corundum cut-off disc FS-D-350A | QATM Coolant, Standard | - Qtool 80 Vario |
| Cutting method | | | |
| Automatic longitudinal or vertical cutting method (with X or Y-Axis) | | | |
| Parameters | | | |
| Feed speed | Pulse parameter | Cut-off disc rotational speed | |
| > 0,3 mm/s | Without pulse | 2000 rpm | |
| Notes | | | |
| - | | | |

## Hot mounting

| Mounting | | | | | |
|---|---|---|---|---|---|
| Device | Consumable | Heating time | Temperature | Pressure | Cooling time |
| **Qpress 50** | EPO Black | 5 Minutes | 190° C | 300 bar | 4 Minutes |
| Filler or additional consumables | Heating power | Pressure mode | Cooling power | | |
| Bakelit | 100 % | Pressure from beginning | 100 % | | |
| Notes | | | | | |
| - pre-grind the sample to remove the burr before mounting<br>- this parameter recommendation is for mould ø 40 mm<br>- use two spoon EPO Black and 2 spoon Bakelit | | | | | |

# QATM-Preparation method


Figure 2. Overview of the cutting machine Qcut 400 A

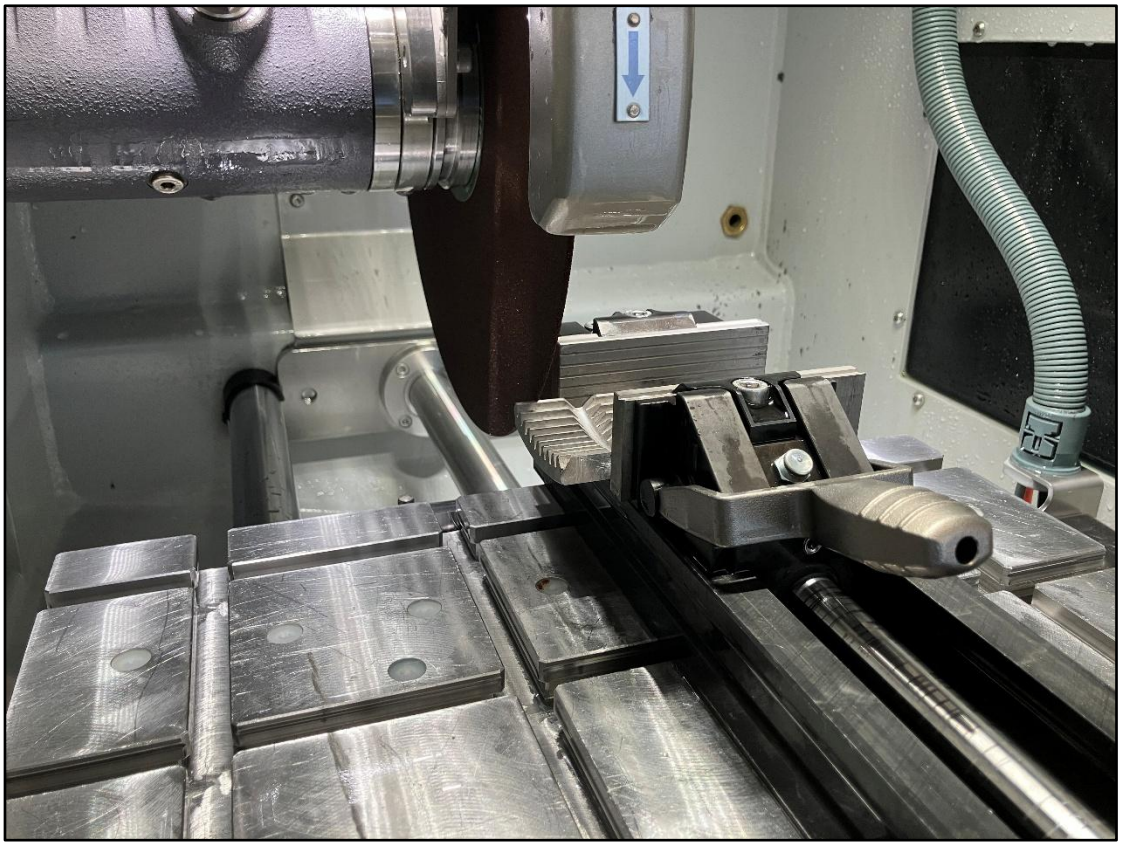


Figure 3. Recommendation for the clamping tool

## QATM-Preparation method

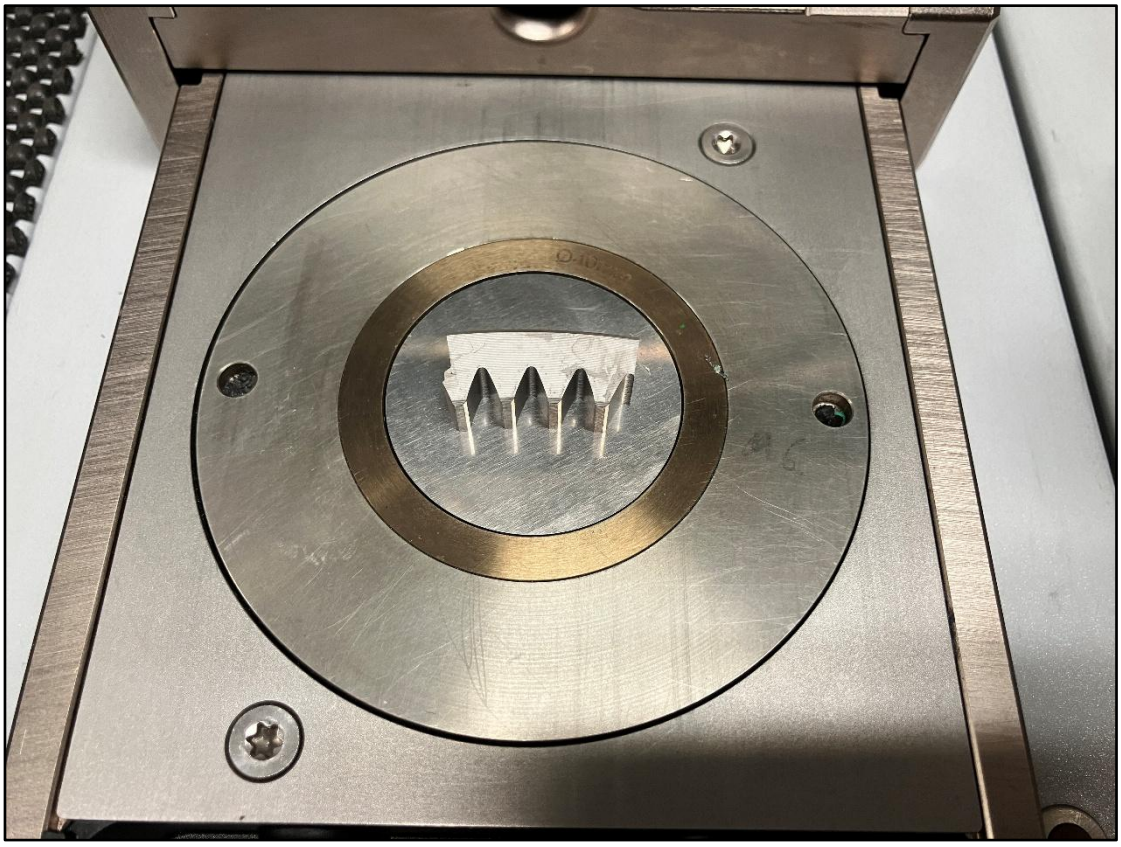


Figure 4. Sample before mounting

Figure 5. The mounted sample

# QATM-Preparation method

## Grinding/Polishing

| Device | Samples holder | Pressure mode | | | | |
|---|---|---|---|---|---|---|
| **SAPHIR 550** | Z5400203 | Single | | | | |
| **Step** | **MEDIUM** | | **RPM** | | **N** | **min** |
| Planar grinding | SiC-Paper, PSA, P320 | $H_2O$ | 200 | 100 ◄ ► | 15 | 1:00 |
| Grinding | SiC-Paper, PSA, P600 | $H_2O$ | 200 | 100 ◄ ► | 15-20 | 1:00 |
| Grinding | SiC-Paper, PSA, P1200 | $H_2O$ | 200 | 100 ◄ ► | 15-20 | 1:00 |
| Polishing | GAMMA | Dia. suspension Wb. Poly, **3 µm** | 150 | 100 ►► | 30 | 5:00 |
| Polishing | ZETA | Dia. suspension Wb. Poly, **1 µm** | 150 | 100 ►► | 30 | 1:30 |
| Etching (chem.) | 3% alc. NITAL | | | | | 0:03 – 0:05 |

Notes

- Pre-dosing for 3 µm und 1 µm: 3 s
  Dosing interval and dosing duration for Dia. Suspension 3 µm, 1 µm:
  Every 30 s for 1,5 s
- ZETA 1 µm is only to if scratch-free sample surface is needed

## QATM-Preparation method

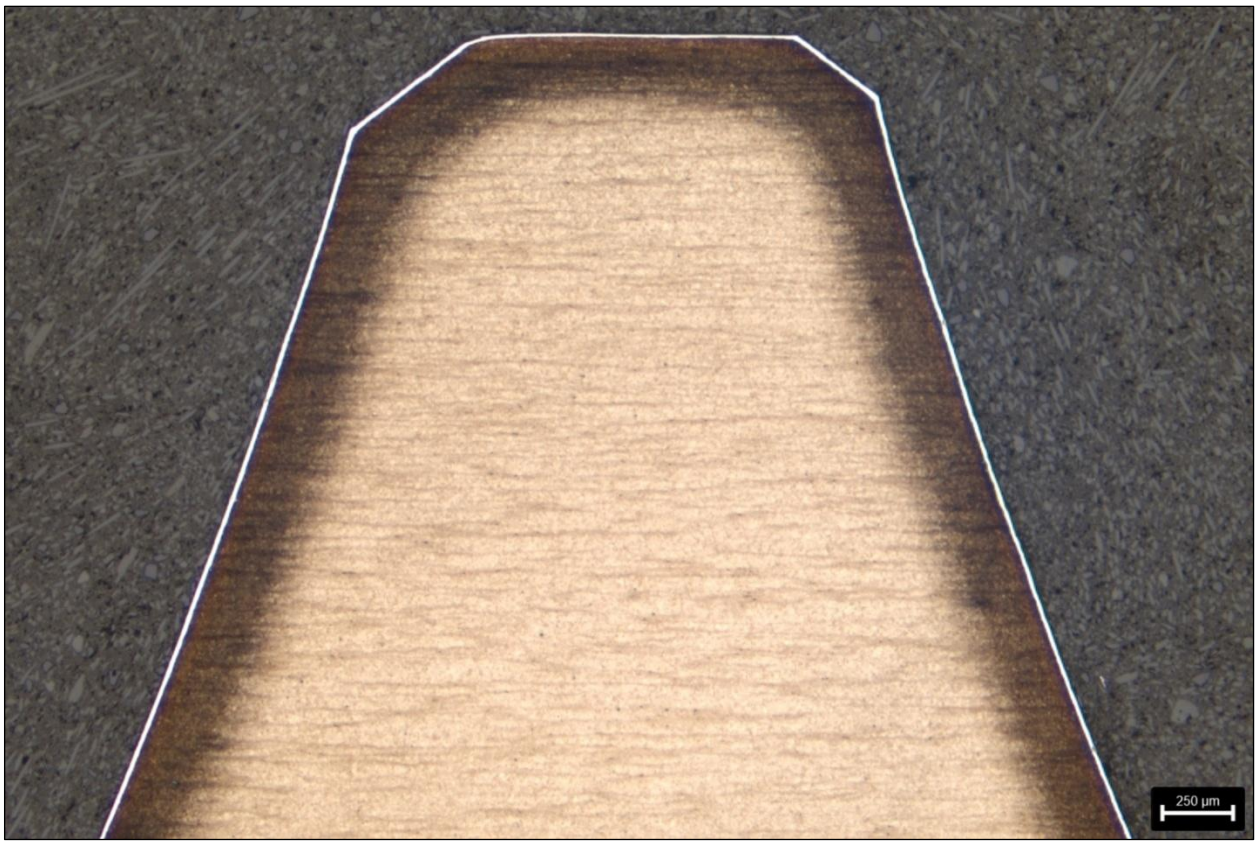



Figure 6. Edge area after GAMMA 3 µm and etching with NITAL – 25:1

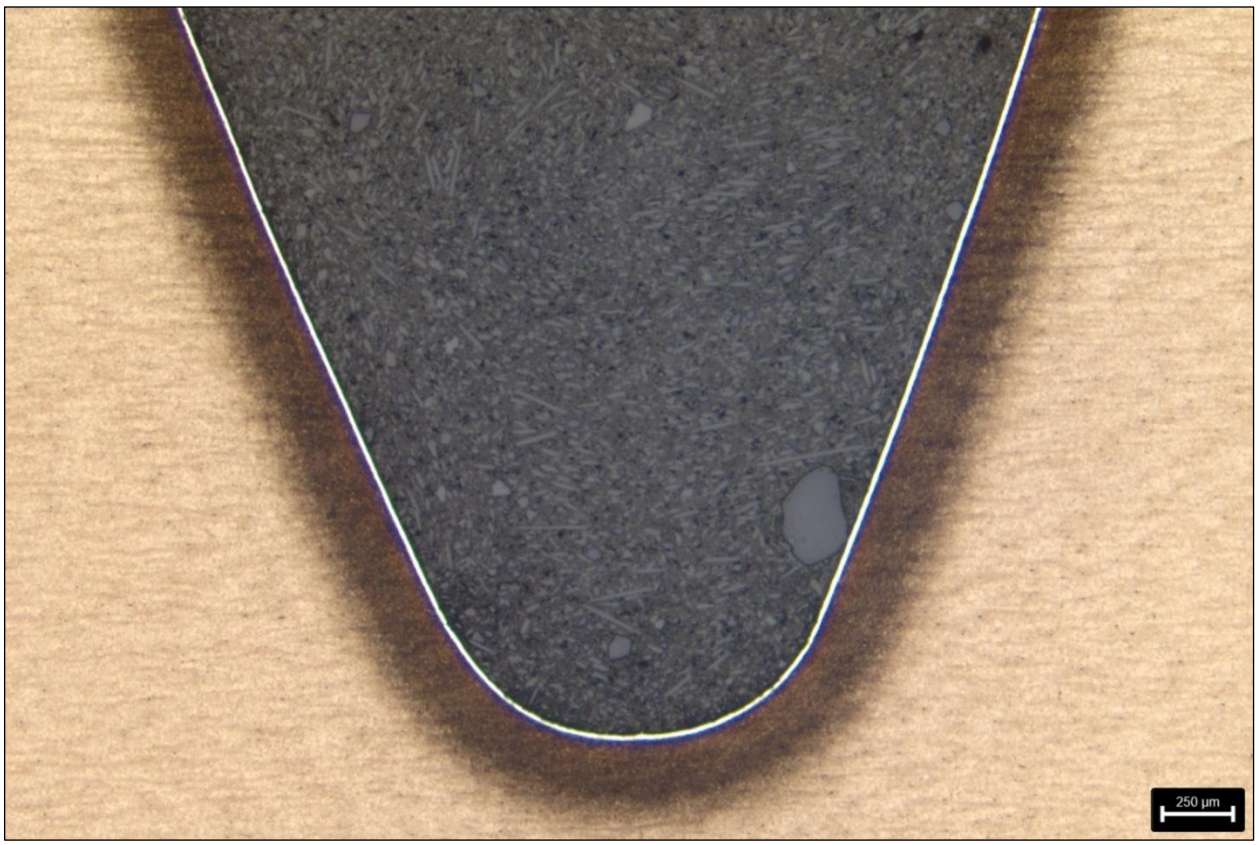



Figure 7. Edge area after GAMMA 3 µm and etching with NITAL – 25:1

## QATM-Preparation method

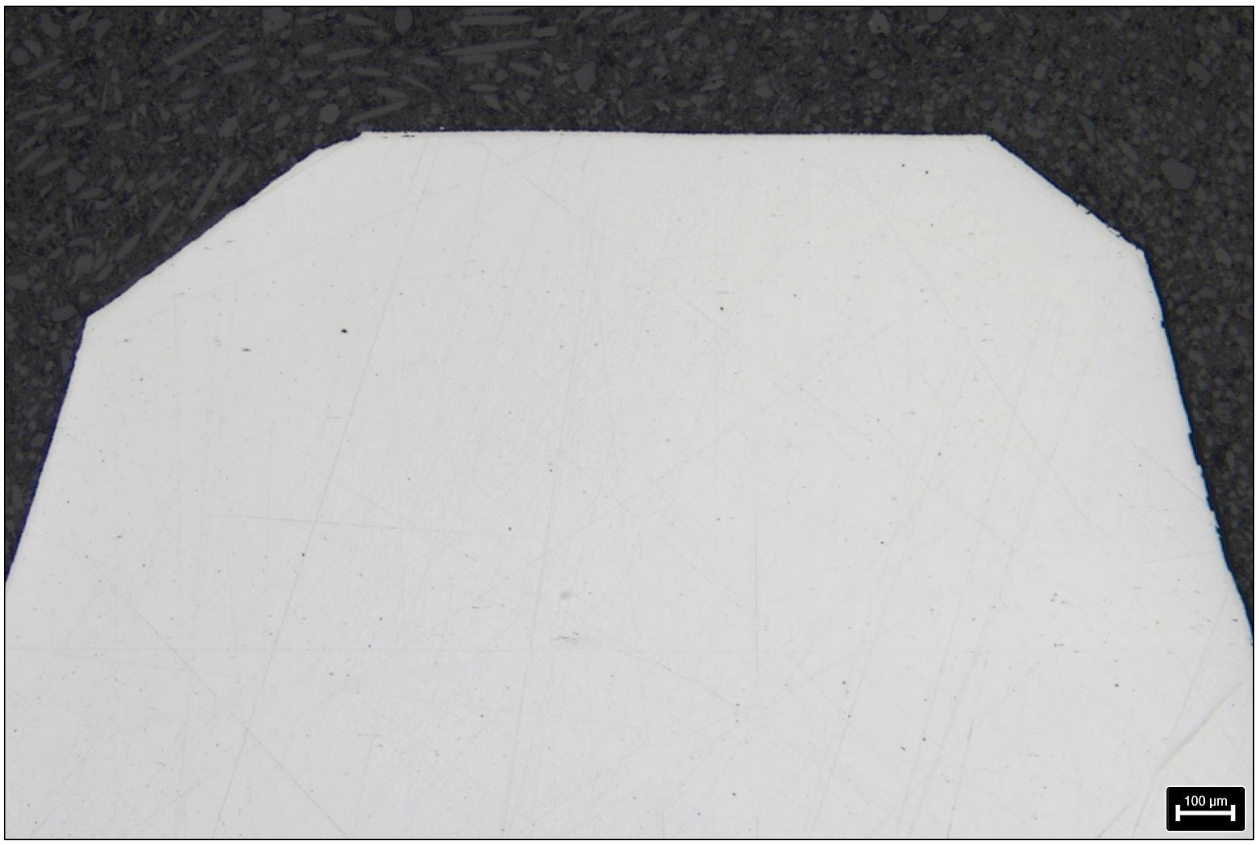



Figure 8. Edge area after GAMMA 3 µm - 50:1

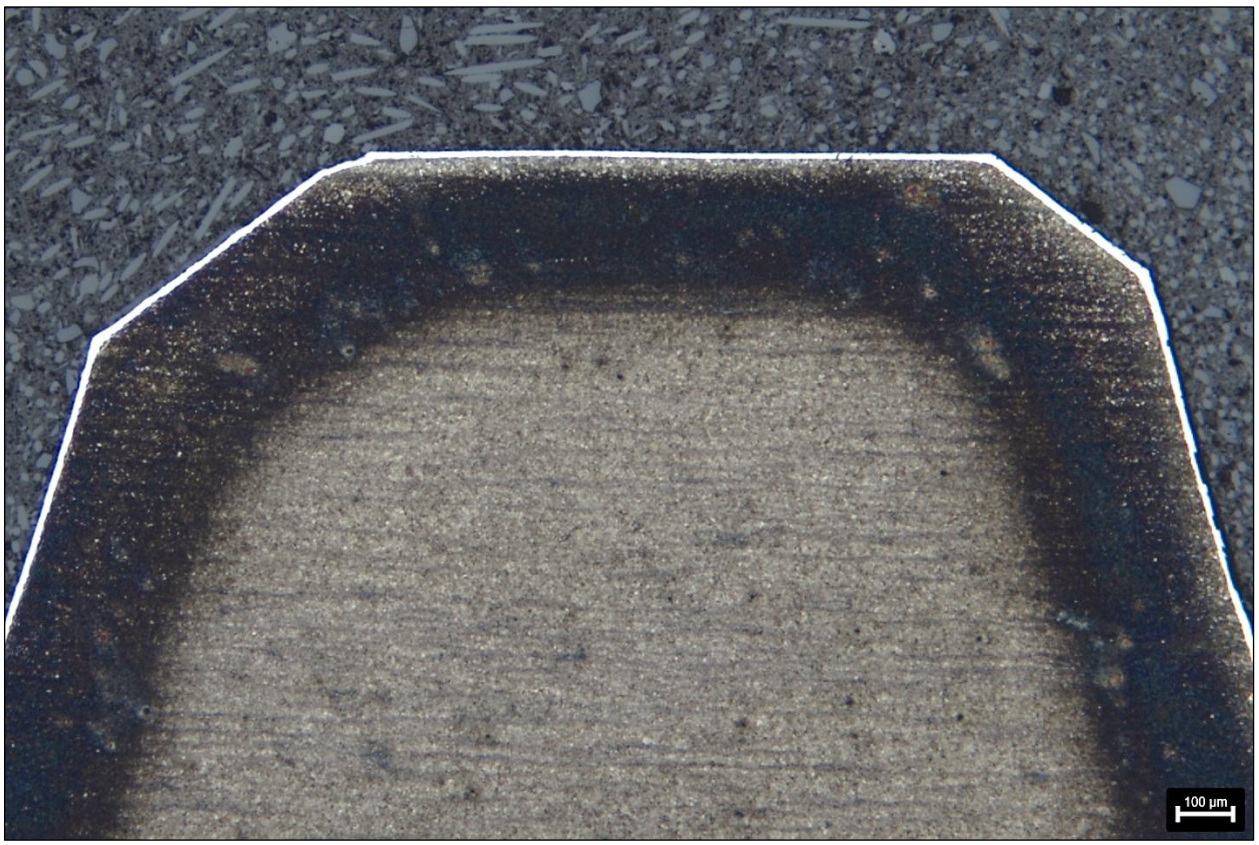



Figure 9. Edge area after GAMMA 3 µm and etching with NITAL – 50:1

# QATM-Preparation method

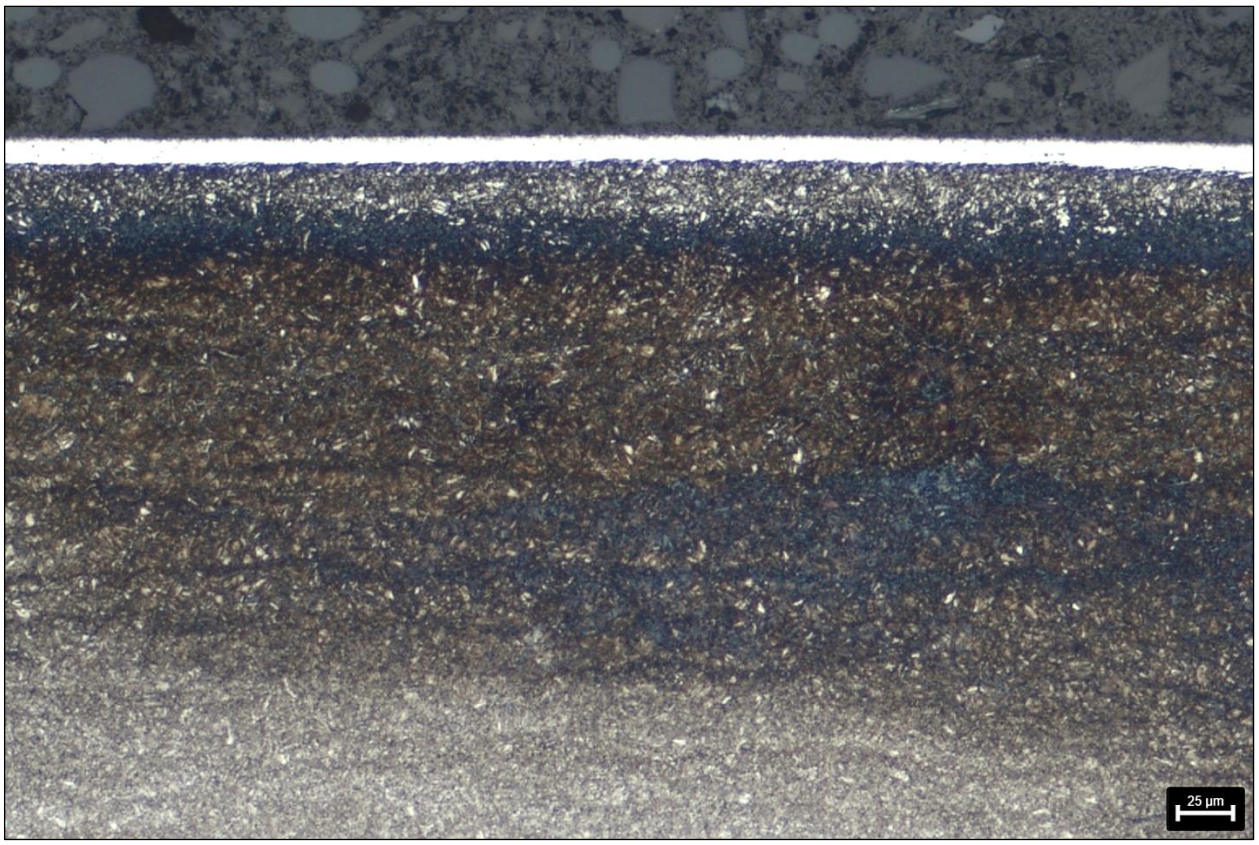



Figure 10. Edge area after GAMMA 3 µm and etching with NITAL – 200:1

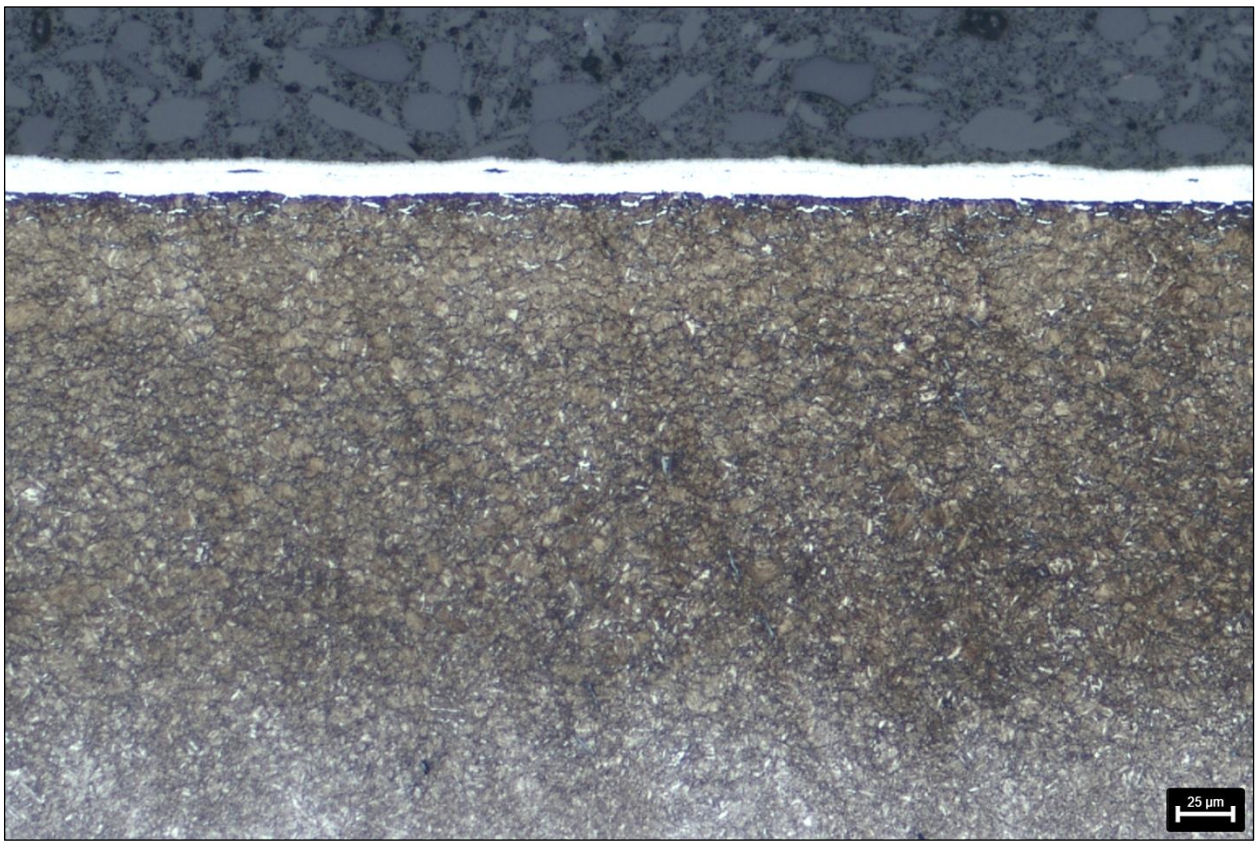



Figure 11. Edge area after ZETA 1 µm and etching with NITAL – 200:1

# QATM- Preparation method

## Conclusion

The cutting machine Qcut 400 A can be used very well for the cutting process of the parts. Even if the parts should be bigger it is suitable to use the machine for the cutting process. We recommend the Qtool 80 Vario as a clamping tool. This clamping tool is universal. Big or small samples can be clamped with this clamping tool optimally. We recommend to pre-grind the cutted sample after cutting and before the mounting process.

We recommend to use EPO Black as a mounting resin because this resin has the smallest gap. As a filler-resin please use Bakelit.

Because of the very brittle nitrided surface layer SiC-paper is to use as grinding consumable. To avoid edge rounding we recommend to use the SiC-Paper with self-adhesive (PSA) backside. For easy handling of the self-adhesive SiC-Paper use the Galaxy X-Tap. Grinding till step SiC-paper, P1200 is enough. The polishing step with GAMMA and 3 µm is needed and allowes perfect examination of the edge area. The polishing step with ZETA and 1 µm is only to use if absolute scratch-free polishing result is needed.

For etching we recommend 3% alc. based NITAL. Don’t do the etching longer the 5 seconds.

The hardness test was made with the hardness tester Qness 60 A+. The test was made with method HV0,1 and HV0,3. Both methods was made on unetched and etched surface. The hardness test report is not included in this report.